ABSTRACT OF THE DISCLOSURE

The present invention is a distillation plant utilizing the solar energy for obtaining distilled water from saline or dirty water in large scale. The plant consists of a double chamber embodiment, that is, a main chamber known as vaporizing chamber and an auxiliary chamber known as condensing chamber. The vaporizing chamber is constructed in bell shape with transparent material like glass and the condensing chamber is also made of the transparent material but in oval shape. The evaporating chamber is surmounted by the condensing chamber, in such a way that the neck of the bell of the evaporating chamber penetrates into the bottom of the condensing chamber. The embodiment of the chambers forms the main structure and is erected on a suitable foundation wall in the form of a well constructed over a reservoir of impure water. The chambers and the portion of water enclosed by the foundation in the reservoir are completely airtight. Since the chambers are constructed with transparent material, the sun's rays can pass through them and fall on the surface of the water enclosed in the well of the main chamber. The foundation wall has holes at different levels below the water surface to have continuity of water outside the well. The shallow portion at the bottom of the condenser chamber is connected by an outlet pipe to a cistern, which is placed outside the condensing chamber and below the level of the shallow space. The cistern is again connected by a siphon pipe to a water storage tank kept far below the cistern. Beside the main structure, there is a solar heater system consisting of a solar dish containing a set of heat receiving black tubes, called the heating tubes. These tubes are filled with a volatile coolant and fitted with an arrangement of automatic coolant circulating arrangement to pass the hot coolant from the heating tubes into a set of black tubes with fins called the heat exchange tubes spread over the surface of the water enclosed in the well of the main chamber.

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There is a reflector in the form of open cylindrical shell surrounding the main structure to reflect the sun's radiations on to the surface of the water enclosed in the well of the main chamber.

Thus the various accessories and arrangements are incorporated in the plant to facilitate heating the water more effectively. Some of the water enclosed by the plant is evaporated due to the latent heat received from the solar radiations. The water vapor, so produced in the main chamber that is, in the evaporating chamber, rises up and passes through its neck into the condensing chamber. The water vapor collected in the condensing chamber is cooled naturally and condenses as distilled water in the shallow space at the bottom of the condensing chamber. The distilled water flows out of the condensing chamber into the cistern by gravity. The water in the cistern is finally collected in the storage tank by means of the siphon.

BACKGROUND OF THE INVENTION:-

It has long been known that fresh water can be produced from impure or saline water by many processes such as distillation, freezing and etc. In many of the processes large amount of energy is spent and complicated equipment utilized, making them very expensive in operation and maintenance. Therefore, it is desired to develop a method utilizing solar energy, as it is freely and abundantly available in nature. There are many designs of such plants already in existence utilizing solar energy, for obtaining potable water. The present invention, the SOLAR DESALINATION PLANT is one of such designs but, substantially departs from the other conventional concepts and designs of prior art. This is a plant primarily developed for the purpose of producing fresh or distilled water, with such an apparatus to utilize maximum amount of available solar energy by additional systems which are more efficient and simple in construction, and very much less in operational and maintenance costs. The plant is environment friendly since no fuels are used in its operation and it is very efficient since no other energy is utilized in working of any device of the plant than the solar energy.

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OBJECTS OF THE INVENTION:-

It is therefore, an object of the present invention to provide a new SOLAR DESALINATION PLANT which utilizes solar energy for producing fresh or potable water out of saline or any other dirty water containing undesirable solvents.

It is another object of the present invention to provide a SOLAR DESALINATION PLANT and a method which has many advantages by additional means with novel functions that result in the new SOLAR DESALINATION PLANT which is not anticipated, rendered obvious, suggested or even implied by any of the prior art of desalination plants either alone or in any combination thereof for distillation and thereby purification of water mentioned heretofore.

It is yet another object of the present invention to provide a new SOLAR DESALINATION PLANT which is to be simple in construction and more efficient in functioning.

It is a further object of the present invention to provide a new SOLAR DESALINATION PLANT that will be durable and reliable in construction and working.

An even further object of the present invention is to provide a new SOLAR DESALINATION PLANT that is susceptible of low cost of operation and maintenance with regard to both materials and labor, and which accordingly is then susceptible of low price of the derivation to the consuming public, truly making such SOLAR DESALINATION PLANT economically viable to the public.

Still yet another object of the present invention is to have a new SOLAR DESALINATION PLANT that could provide in the apparatus and methods the advantage of higher efficiency over some of the prior art thereof without simultaneously expending other additional energy in functioning of any device associated therewith.

Still another object of the present invention is in general to provide a new SOLAR DESALINATION PLANT with a purpose of presenting an environmental friendly device, by avoiding any effluents or pollutants into the atmosphere.

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The abstract together with the objects of the invention along with various features of novelty, which characterize the invention, are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For better understanding of this invention, its operating advantages and the specific objects obtained by its use, reference should have to be made to the accompanying drawings and descriptive matter in which there is an illustrated preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS AND EMBODIMENT:

The present invention, the SOLAR DESALINATION PLANT will be better understood and the objects even other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings, wherein:

Fig.1 is a schematic diagram of the present invention SOLAR DESALINATION PLANT, showing the front view in vertical cross section.

Fig.2 is a schematic diagram of top view of a set of heat receiving tubes that is, the heating tubes in the solar dish with an arrangement of automatic coolant circulating system.

Fig.3 is a schematic diagram of top view of a set of heat transfer tubes that is, the heat exchange tubes having fins, placed on the surface of water in the well of the main chamber.

As required, detailed embodiments of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention that may be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to employ variously the present invention in virtually any appropriately detailed structure.

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In the Figs.1, 2 and 3, the various parts of the plant housing are represented by reference numerals.

They are:

Main chamber or the vaporizing chamber 1, auxiliary chamber or the condensing chamber 2, foundation wall in the form of a well 3, reservoir of water 4, holes 5, foundation 6, shallow space 7, outlet pipe 8, cistern 9, siphon pipe 10, water collecting tank or tank 11, air vent cum over-flow pipe 12, water tap 13, solar dish 14, lower cross pipe 5, set of heating tubes 16, upper cross pipe 17, spring diaphragm 18, cover 19, automatic non-return spring valve 20, expansion cell 21, automatic one-way valves 22, 23 and 28, outlet tube 24, set of heat transfer or heat exchange tubes 25, elastic springs 26, coolant inlet tube 27 and cylindrical open shell reflector 29.

CONSTRUCTION AND SET UP :-

The foundation wall 3 is constructed in the form a well on the foundation 6 in the water reservoir 4. Large holes 5 are made in the wall 3, below the water surface, such that, some are to be near the bottom of the reservoir and some above them. The transparent main chamber called the evaporating chamber 1, is made in the shape of a bell. It is suitably mounted on the wall 3 of the well. The other transparent chamber that is the condensing chamber 2, is fixed to be on top of the evaporating chamber 1 in such a way that the neck of the bell of the evaporating chamber1 slightly protruding in to the bottom of the condensing chamber 2. The space at the bottom of the condensing chamber around the neck of the bell, forms the shallow space 7. Thus the embodiment of the chambers is erected on the foundation wall 3 standing in the water reservoir 4, making the inside portion of the chambers to be airtight. An outlet pipe 8 made up of transparent material, connects the shallow space 7 and the cistern 9 which is outside the main chamber and below the level of the shallow space. The end of the pipe 8, which is inside the cistern, is kept at the bottom of the cistern.

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A siphon pipe 10 connects the cistern 9 and the tank 11. The end of the siphon pipe inside the cistern is kept a little above the end of the outlet pipe in the cistern and the other end of the siphon pipe that is inside the tank 11, is fixed to be near the bottom of the tank. The tank 11 is kept far below the cistern 9. A short pipe 12 is provided at top of the tank 11, to act as an air vent as well as an overflow pipe. The tap 13 is fixed at the bottom of the tank 11. The solar dish 14 is made in the shape of a concave disc. The inside portion, that is the concave surface of the dish 14 is made silver white. Black painted metallic tubes of equal lengths are placed parallel and adjacent to one another in a plane, forming a set of heating tubes 16. The ends the tubes on one side are fixed into a cross pipe called the lower cross pipe 15 and other ends of the set are fixed into another cross pipe called upper cross pipe 17. The set of the heating tubes 16 is kept at the principal focus of the solar dish 14 in such way that the plane of the set of the tubes to lie slightly inclined to the horizontal plane as the lower cross pipe 15 being at lower level than the upper cross pipe 17. One end of the upper cross pipe is fitted with a spring diaphragm 18 and the other ends of the cross pipes are closed. The upper cross pipe 17 is connected to the expansion cell 21 fixed outside the solar dish, through the automatic non-return spring valve 20 which can open towards the expansion cell 21. The solar dish 14 is closed with airtight concave transparent cover 19. Connection is provided from the expansion cell 21 to coolant outlet tube 24 through the automatic one-way valve 22, which closes towards the expansion cell 21. The upper cross pipe 17 is also connected to the outlet tube 24 through the automatic one-way valve 23 which closes towards the upper cross pipe 17. The out-let tube 24 is connected to one end of the set of heat exchange tubes 25. The other end of the set of the heat exchange tubes 25 is connected to the coolant inlet tube 27 which is connected to the lower cross pipe 15 through an automatic one-way valve 28 that can open towards the lower cross pipe 15. The set of heat exchange tubes is held by elastic strings or springs 26 to be parallel to the surface and partially immersed in the water of the well of the main chamber 1.

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The outlet tube 24 is thermally insulated all through its length from the solar dish to the heat exchange tubes. A volatile liquid coolant is filled in to be in the heating tubes 16, the cross pipes 15 & 17, the outlet tube 24, the heat exchange tubes 25 and the inlet tube 28.

The main chamber that is, the evaporating chamber 1 is surrounded by the reflector 29 which is in the form of a Vertical open cylindrical shell. The inside surface of the cylindrical shell is made silver white to form the reflecting surface.

WORKING AND OPERATION:-

The sun's rays directly pass through the transparent chambers 1 & 2 and fall on the black colored heat exchange tubes 25 and their fins, placed on the surface of water in the reservoir 4. The tubes and fins get heated due to the sun's radiations and transfer the heat to the water in contact with them. Thus the water in the well of the main chamber1 is heated by the sunrays falling directly through the chambers.

The sunrays falling on the solar dish 14 are concentrated on the heating tubes 16 at the principal focus of the dish due to reflection by the silver white concave surface of the dish. The heating tubes 16 receive the heat from the concentrated solar radiations and so the coolant filled in them is heated. Due to the heating, some of the coolant becomes vapor. When the vapor pressure increases to a pre-set point of the non-return spring valve 20, the valve opens allowing the vapor to pass into the expansion cell 21 instantly. This causes sudden fall of pressure inside the upper cross pipe 17. Due to the sudden drop in pressure, the spring diaphragm 18 of the upper cross pipe is pulled inwards. But, by the spring action, the diaphragm 18 tends to go back to its normal position, in so doing, some coolant is sucked into the heating tubes from the inlet tube 27 through the valve 28 and this action makes the hot coolant from the heating tubes to pass into the heat exchange tubes 25 through the outlet tube 24. Thus the water in the well of the main chamber 1, is heated by means of the heat exchange tubes 25 by transferring the heat from the coolant to the water as the coolant is heated by the solar radiations received by the solar dish.

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Thus, the coolant that is heated in the heating tubes16 of the solar dish, passes automatically through the heat exchange tubes 25 in the main chamber 1. The means and the accessories aiding the passage of a coolant from the heating tubes into the heat exchange tubes, and returning it to the heating tubes, constitute automatic coolant circulating system. Therefore, by the automatic coolant circulating system, the coolant that is heated by the sun's rays in the solar dish, passes through the outlet pipe 24 into the heat exchange tubes 25 and transfers the heat to the water in contact with the tubes and vanes in the well of the main chamber 1.

When the sunrays are not vertically incident on the main chamber, the rays are reflected by the inner surface of cylindrical shell 29 to fall on the heat exchange tubes 25, to heat the water in contact with them in the well of the main chamber 1.

As the water in the well of the main chamber, the evaporating chamber 1, is heated by the solar radiations, water vapor is produced due to the latent heat. The water vapor produced in the evaporating chamber 1, rises up, passes into the condensing chamber 2. Since the temperature inside the condensing chamber 2 is naturally lower than that of the evaporating chamber because of its position above the evaporating chamber 1, the water vapor condenses in the condensing chamber 2. The condensed water droplets drip over the inner surface of the chamber and collect at bottom of the condensing chamber in the shallow space 7. The water from the shallow space 7 passes out through the outlet pipe 8 into the cistern 9 due to gravity. When the level of the water in the cistern goes above the head of the siphon pipe 10, the water suddenly runs through the siphon pipe into the water tank 11, due to gravity. Therefore, suction is produced in the cistern automatically and intermittently as the cistern empties every time when it is full by siphon action. The intermittent suctions produce intermittent low pressures in the condensing chamber 2. This action enhances evaporation and condensation. The solar distilled water, which is finally collected in the tank 11, is drawn out through the tap 13 for consumption.

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